Remarks/Arguments

Claims 1, 3, and 6-44 are pending in the present application. Claims 32-41 are withdrawn from consideration herein. Claims 1, 3, and 6-10 are rejected. Claims 11-20 are objected to as being dependent on a rejected base claim. Claims 21-31 and 42-44 are allowed.

Applicants appreciate the acknowledgement of allowed claims in the application.

Rejection under 35 U.S.C. §103:

The Examiner has rejected claims 1, 3, and 7-10 under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent No. 4,937,150 to Tsukada (the '150 reference). The Examiner contends that the '150 reference discloses an ultrafine grain fluorescent body comprising an ultrafine grain luminescent materal such as ZnS containing an activator such as Eu, noting claims 1 and 2, and additionally that the reference discloses that the grain size of the luminescent material is from several hundred to several thousand Angstroms and the luminescent layer for an electroluminescent device comprises the fluorescent material, ZnS:Eu and has a thickness of 50 to 100 microns, citing column 6, lines 3-19. The Examiner acknowledges that the reference does not disclose an atomic ratio of the activator material to zinc of from about 0.005 to 0.02, but finds this to be an optimizable feature. Applicants respectfully traverse.

The present invention is a rare earth activated zinc sulfide phosphor film. It is fine grained and has a morphology which minimizes or prevents reaction with oxygen. This is important to the invention because oxygen causes degradation of the phosphor. See, for example the disclosure at paragraphs [0081], [0085], [0088], [0093], etc.

The '150 patent discloses an electroluminescent layer that is a fluorescent body of ultrafine grains dispersed in an organic binder. The grains have a surface layer containing the same metallic element as the luminescent material, this material being selected from an oxide, nitride, sulfide or chloride (see column 4, lines 31-34, and cliam 1). Overall a dot matrix is achieved. The

fluorescent body can be ZnS doped with Mn, and then surface treated with a film of oxide, nitride, etc. In forming the fluorescent body, oxygen is supplied to the treatment apparatus to oxidize the surface of the grains (see column 4, lines 54-61). Accordingly, it is desirous to bring oxygen gas into uniform contact with the grains and prevent the sintering of the grains (see column 4, lines 62-66).

The Examiner contends that the '150 reference discloses the claimed invention except for the atomic ratio of activator to zinc. However, applicants claims recite a thin film of a rare earth metal activated zinc sulfide with a grain size of up to 50 nm and an atomic ratio of Te or Eu to zinc of 0.005 to 0.02. This structure is not disclosed by the '150 reference, which teaches a coated particle within a PMMA matrix forming a layer of a dot matrix as a phosphor. Further, the '150 reference teaches incorporating oxygen on the grains, which is not within the subject invention as seen throughout the application (for example, at paragraphs [0081], [0085], [0088], [0093], etc. cited hereinabove). Therefore, the subject invention in fact teaches away from any incorporation of oxygen, especially when the phosphor layer is provided with an interface modifying layer to prevent oxygen from reacting with the phosphor. The '150 reference also teaches avoidance of sintering (see column 4, lines 62-66), whereas the present application teaches annealing the phosphor to achieve the desired crystal structure.

The '150 reference makes no reference to the ratio of activator to zinc. The examiner takes this as a teaching of any ratios of activator to zinc. Applicants disagree. The '150 reference, at column 4, recites only that an activator powder is heated in an apparatus. The grains are then treated to diffuse the activator before surface treatment. This teaching, however, not only lacks any specifics regarding the ratio required by the current claims, but is so broad as to be no teaching at all. Nowhere does the reference teach any ratios, and due to the very different structure of the coated particles and method of making them as set forth in the '150 reference, one of skill in the art is provided with no knowledge of how to optimize the '150 reference particles with respect to an activator to zinc ratio or what the same will achieve. The fact that the '150 reference is silent with respect to any ratio, let alone that claimed by applicants, cannot teach or lead one

to the optimization of the same; i.e., no indication is provided regarding why the ratio is important, what the ratio should be, or how it may be achieved.

Further, the coating produced on the '150 reference particles is critical to providing the luminance within the matrix. Coated particles of the type in the '150 reference are completely different from those claimed by applicants, which have a layer of ZnS:Re with a sphalerite crystal structure. There is no matrix per the '150 reference teaching in the subject invention. Therefore, even if some ratio of activator to Zn were provided in the reference, which it is not, it does not follow that the ratio would necessarily be suited for the subject phosphor, and in fact it would not be.

The Examiner has further rejected claims 1 and 6 under 35 U.S.C. §103 as being unpatentable over Tsukada, the '150 reference, as cited and discussed hereinabove, in view of Hampden-Smith, U.S. Patent No. 5,837,320 (the '320 reference). The Examiner cites the '150 reference for the same reasons as discussed hereinabove and further notes that the reference does not disclose that the fluorescent material is a sphalerite. The Examiner looks to the '320 reference for disclosure of such fluorescent material. Applicants respectfully traverse.

As the '150 reference has been fully discussed hereinabove, that argument is not repeated herein, but is equally applicable to this rejection. The '320 reference discloses the production of ZnS films by a completely different method than that of the subject application, but does produce some sphalerite in some phases. However, the sphalerite is not the only crystal structure taught. In contrast, the present application claims that the phosphor has a sphlalerite structure and not a mixture of structures. This disclosure, taken with those shown above regarding the '150 reference, causes the combination to fail to teach or even suggest the invention recited by the claims of the present application.

CONCLUSION

In view of the foregoing comments, Applicants submit that claims 1, 3, 6-32, and 42-44 are in condition for allowance. Applicants respectfully request early notification of such allowance. Should any issues remain unresolved, the Examiner is encouraged to contact the undersigned to attempt to resolve any such issues.

Respectfully submitted,

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